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THE COMMITTEE ON EDUCATIONAL RESEARCH
Faculty of Education
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Editorial

The concern of all of us about the lengthening of school days for most children—Education Eating Up Life, Stephen Leacock called it—may be lightened somewhat by the conclusions reached by Beaton in her study of acceleration. Measures designed to abbreviate the period from school entrance to matriculation have had to break, somehow, the shackles of the grade system. Miss Beaton's study does not concern itself, however, with the means of acceleration but only with the consequences. These seem favorable to a wider adoption of acceleration practices.

Meredith's study is one of group action, or in more formidable terms, of group dynamics, applied to the prosaic business of curriculum construction and revision. If a tedious, and usually a distasteful, task can be made pleasant, entertaining, and educationally beneficial to everyone implicated in it, all sitting and prospective committee members will hail Mr. Meredith. In a committee-conscious age this includes most of us.

The Jardine study is partly historical and the Buckles study exclusively so. The one relates to science in the high school and the other to mathematics. Without historical perspective man is blind. Now, no longer need appraisors, critics, protagonists, curriculum makers and revisors suffer from historical blindess in these two fields. We are happy to present these studies.

Dr. Dunlop contributes a brief survey of educational research in Scotland. This will be followed at a later date by a similar review of research in England, and possibly by something similar for Australia. These will be valuable for comparative purposes, and especially valuable to students in education.

Since the inception of this Journal in March, 1955, Dr. Harold S. Baker has looked after its destinies. Seven numbers have appeared, each a tribute to his editorial skill. In an early editorial (Vol. I. No. 2) he confessed, "Mistakes have been made, and there will no doubt be more of them." In point of fact mistakes have been few, and readers will agree that a high level of excellence has been maintained. As the first editor-in-chief Dr. Baker established patterns of style, of format, footnotes and biographic usages, and of course of editorial policy in its entirety.

Fresh administrative duties now make it desirable that Dr. Baker be relieved of his editorial responsibilities. The Journal owes him a heavy debt of gratitude.

THE EFFECTS OF ACCELERATION ON THE ACADEMIC PROGRESS AND ON THE PERSONAL AND SOCIAL DEVELOPMENT OF EDMONTON AND CALGARY GRADE X STUDENTS

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A study of "Promotion Practices and Policies in Alberta Schools," reported by Clarke,[1] showed that during the school term 1953-54, only 0.42 per cent of a total of 80,649 students in grades one to eight in Alberta schools was accelerated. At the end of the year, the percentage of students who were to be failed was 5.4.

If the lower limit of selection is set at an intelligence quotient of 120, approximately 7 per cent of the school population is mentally superior. Should this group be accelerated?

The answer to this question depends in part on what has happened to those pupils who have been advanced more rapidly than usual. Has acceleration interfered with their scholastic achievement? Have they developed in a satisfactory way socially and personally?

Terman and Oden[2] advocate that students having intelligence quotients above 135, should be accelerated one or two years. Witty,[3] Trusler,[4] Pressey,[5] and Worcester,[6] favor the moderate use of acceleration for children of above average ability. Justman[7] found that the academic progress of intellectually gifted senior high school students who had been accelerated was just as satisfactory as that of non-accelerated students of comparable ability.

The present study was an attempt to compare the academic achievement of accelerated Edmonton and Calgary students with that of non-accelerated students. Furthermore, answers to the following questions were sought: Would the self-ratings of personal and social adjustment by accelerated students be similar to those

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1S. C. T. Clarke, "Promotion Practices and Policies in Alberta Schools," **Alberta Journal of Educational Research,** (December, 1955) pp. 24-34.

2Paul Witty, editor, **The Gifted Child,** p. 43.

3Paul Witty, "Education for the Talented and for Leadership," **Teachers' College Record,** (February, 1956), pp. 298-299.

4J. W. Trusler, "Pupil Acceleration in the Elementary School," **Grade Teacher,** (October, 1949), pp. 16-17, 96-98.

5S. L. Pressey, **Educational Acceleration: Appraisals and Basic Problems.** Bureau of Educational Research Monographs No. 31.

6D. A. Worcester, **The Education of Children of Above Average Ability.**

7J. Justman, "Academic Achievement of Intellectually Gifted Accelerants in Senior High School," **School Review,** (November, 1954), pp. 469-473.

made by students who had completed one grade each year? Would the teachers of accelerated students rate them as highly as other students on a scale of personal and social traits? Were accelerated students as active socially as others? Were they chosen as frequently to play on athletic teams? Were they leaders as often as were non-accelerated students? Were accelerated students in favor of rapid promotions?

Procedure

A promotion questionnaire was given to all Edmonton and Calgary Grade X classes in order to identify the accelerated students. Of the 2,618 students who completed the promotion questionnaire, 119 were included in the final accelerated group. A student was classified as having been accelerated if he had entered Grade I before the age of five and one-half years, or if he had entered Grade I before the age of six and one-half years and later had skipped a grade, or if he had entered Grade I before the age of six and one-half years and later had completed two grades in one year. A student from any of the three above categories who later failed was included. Any pupil who failed and who later was accelerated was omitted.

Each accelerated student was matched with a control student according to sex and school attended during the current year. With thirteen execptions, the accelerated students were taking the same scholastic course as their corresponding control students. The Terman-McNemar Test of Mental Ability was administered to both the accelerated and control students. The two groups were equated satisfactorily with respect to mean intelligence quotients.

Table I presents the distribution of Terman-McNemar intelligence quotients for the accelerated students. The mean intelligence quotient for the total accelerated group was 122.1 with a standard deviation of 11.1 whereas the mean intelligence quotient for the control group was 122.1 with a standard deviation of 9.6. The distribution of Terman-McNemar intelligence quotients for the control group is given in Table II.

The accelerated students were divided into two groups, the superior accelerated students having intelligence quotients of 120 or over and the normal accelerated students having intelligence quotients below 120. Table III shows that both groups were equated satisfactorily with control groups with respect to mean intelligence scores.

There was of necessity a difference in mean age between the accelerated and control students. The mean age for the total group of accelerated students was fourteen years and nine months. The mean age for the complete control group was fifteen years and five

months. The distributions according to age for the four groups are given in Tables IV and V. The greatest difference in age was found between the superior accelerated group and the superior control group. The difference in mean age for these groups was nine months. A difference of six months was found between the mean age of the normal accelerated students and the normal control students.

TABLE I

DISTRIBUTION OF TERMAN-McNEMAR INTELLIGENCE QUOTIENTS FOR ACCELERATED STUDENTS

Terman-McNemar I.Q.	Boys	Girls	Boys and Girls
150-154	.....	1	1
145-149	1	1	2
140-144	.....	5	5
135-139	6	2	8
130-134	9	5	14
125-129	9	9	18
120-124	8	12	20
115-119	5	13	18
110-114	8	12	20
105-109	3	6	9
100-104	.....	2	2
95- 99	.....	1	1
90- 94	.....	1	1
N	49	70	119
Mean	124.0	120.7	122.1
S.D.	9.4	11.8	11.1

TABLE II

DISTRIBUTION OF TERMAN-McNEMAR INTELLIGENCE QUOTIENTS FOR CONTROL STUDENTS

Terman-McNemar I.Q.	Boys	Girls	Boys and Girls
140-144	3	3	6
135-139	6	2	8
130-134	3	5	8
125-129	12	15	27
120-124	8	8	16
115-119	10	13	23
110-114	3	12	15
105-109	3	9	12
100-104	0	1	1
95- 99	1	2	3
N	49	70	119
Mean I.Q.	125.9	119.5	122.1
S.D.	7.8	9.3	9.6

TABLE III

TERMAN-McNEMAR MEAN I.Q.'S AND S.D.'S FOR SUPERIOR AND NORMAL GROUPS

	Superior Accelerated			Superior Control			Normal Accelerated			Normal Control		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
N	33	35	68	33	35	68	16	35	51	16	35	51
Mean I.Q.	129.6	130.0	129.8	132.0	127.7	129.8	112.6	111.4	111.8	113.3	111.3	111.9
S.D.	6.0	8.4	7.3	7.6	6.5	6.8	3.5	6.1	5.4	6.0	5.6	5.8

TABLE IV

DISTRIBUTION OF AGES OF SUPERIOR ACCELERATED GROUP AND SUPERIOR CONTROL GROUP

	Superior Accelerated (I.Q. 120 or above)			Superior Control		
Age in yrs. and mos.	Boys	Girls	Total	Boys	Girls	Total
15-9 to 15-11	.....	1	1	1	1	2
15-6 to 15-8	.....	1	1	1	3	4
15-3 to 15-5	2	2	4	12	11	23
15-0 to 15-2	4	6	10	11	11	22
14-9 to 14-11	12	5	17	8	9	17
14-6 to 14-8	4	7	11	.....	.....	.....
14-3 to 14-5	5	9	14	.....	.....	.....
14-0 to 14-2	4	2	6	.....	.....	.....
13-9 to 13-11	2	2	4	.....	.....	.....
	33	35	68	33	35	68
Mean Age	14-8	14-8	14-8	15-5	15-5	15-5
Range in Months	20	26	26	14	14	14

Academic progress was determined by the results of the Grade IX final departmental examinations. The marks obtained by the accelerated students and the control students in Reading, Literature, Language, Social Studies, Mathematics, and Science were recorded from the files of the Calgary high schools and from the Examinations Branch. Letter gradings were given the following values: H—5, A—4, B—3, C—2, D—1.

TABLE V

DISTRIBUTION OF AGES OF NORMAL ACCELERATED GROUP AND NORMAL CONTROL GROUP

	Normal Accelerated (I.Q. under 120)			Normal Control		
Age in yrs. and mos.	Boys	Girls	Total	Boys	Girls	Total
15-9 to 15-11	.....	2	2	2	4	6
15-6 to 15-8	1	1	2	4	11	15
15-3 to 15-5	.....	3	3	7	8	15
15-0 to 15-2	4	12	16	3	11	14
14-9 to 14-11	6	10	16	.....	.....	.....
14-6 to 14-8	4	.....	4	.....	.....	.....
14-3 to 14-5	.....	4	4	.....	1	1
14-0 to 14-2	1	2	3	.....	.....	.....
13-9 to 13-11	.....	1	1	.....	.....	.....
N	16	35	51	16	35	51
Mean Age	14-10	14-11	14-11	15-5	15-4	15-5
Range	24	30	30	12	21	21

The social and personal development of pupils was studied in several ways. The accelerated and control students were asked, by questionnaire, to state the number of official positions which they had held during the preceding four years, to list the athletic teams for which they had played during the same period of time and to enumerate the social activities in which they had participated during the previous month. Each student was asked to rate himself on a scale of eight personal and social traits, namely, talkativeness, sensitivity, flexibility, persistence, shyness, emotionality, anxiety, and friendliness. The opinions of the accelerated students regarding how acceleration had helped or hindered them in their school work, in their personalities and in their social lives, were solicited.[8]

Teachers of twenty-four accelerated students and the twenty-four corresponding control students were asked to rate them on a scale similar to the self-rating scale mentioned above.

Findings

Academic Progress of Accelerated Students

For each of the six examination subjects, the mean score and standard deviation were computed for the accelerated groups and

[8]The latter part of the student questionnaire was adapted from a survey form used in Crescent Heights High School in Calgary.

the control groups. In each case, the critical ratio was found in order to determine the significance of the differences. The method of comparison was similar to that used by C. Safran[9] in a "Study of the Value of Kindergarten Training in the Calgary School System." Table VI summarizes these data.

TABLE VI

THE SIGNIFICANCE OF DIFFERENCES IN MEAN SCORES OBTAINED IN GRADE IX FINALS BY ACCELERATED AND CONTROL STUDENTS

Superior Groups	Reading	Lit.	Lang.	Soc. St.	Math.	Sci.
Accelerated						
Mean Score	4.4	4.33	4.1	4.16	3.97	3.84
Standard Deviation	0.55	0.58	0.74	0.65	0.82	0.87
Control Group						
Mean Score	4.6	4.45	4.4	4.31	4.03	4.11
Standard Deviation	0.65	0.61	0.69	0.85	0.68	0.87
Critical Ratio	1.96	1.18	2.5	1.23	0.46	1.8
Normal Groups						
Accelerated						
Mean Score	3.31	3.43	3,61	3.33	3.31	3.14
Standard Deviation	0.7	0.72	0.79	0.67	0.78	0.65
Control Group						
Mean Score	3.47	3.43	3.57	3.57	3,33	3.35
Standard Deviation	0.6	0.67	0.67	0.82	0.93	0.88
Critical Ratio	1.23	.....	0.29	1.71	0.11	1.4

The superior control group obtained a higher average mark in all of the six subjects than did the superior accelerated group. The difference in average marks was least significant in Mathematics. The differences in Literature, Social Studies, and Science were not statistically significant. In Reading, the difference was significant at the 5 per cent level. The superior control students made significantly higher marks than the superior accelerated students in Language. The difference was significant at the 1.24 per cent level.

[9]C. Safran, "Study of the Value of Kindergarten Training in the Calgary School System." Unpublished Calgary School Board pamphlet, pp. 4-5.

None of the differences found between the mean gradings obtained by accelerated students whose intelligence quotients were less than 120 and those obtained by the corresponding control students was statistically significant.

The most noteworthy finding with respect to academic progress seems to be that generally the differences in achievement of accelerated and non-accelerated students were not statistically significant. However, the differences found in Reading and Language were in favor of the non-accelerated students.

Social and Personal Development of Accelerated Students

Fewer official positions were held by accelerated students. Accelerated boys belonged to almost as many athletic teams as the control boys. Accelerated girls did not play on as many athletic teams as the control girls. Compared with the control students, accelerated students were less active socially. Table VII presents the mean score and median score for each group with respect to official positions held, athletic team membership and participation in social activities.

TABLE VII

SOCIAL AND PERSONAL DEVELOPMENT OF ACCELERATED STUDENTS

	Superior Accelerated			Superior Control			Normal Accelerated			Normal Control		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Official Positions Held												
Mean	1.3	1.9	1.6	2.1	2.6	2.5	2.2	2.2	2.2	1.6	2.3	2.1
Median	1.1	1.7	1.4	2.4	2.7	2.5	1.8	2.3	2.2	0.9	2.3	2.3
Athletic Team Membership												
Mean	5.3	3.5	4.4	6.8	5.3	6.0	5.5	4.0	5.0	6.2	4.8	5.2
Median	4.9	3.1	3.8	4.8	4.8	5.3	4.5	3.6	4.0	6.2	4.8	5.2
Participation in Social Activities												
Mean	10.2	12.1	11.2	11.8	12.3	12.1	11.9	10.3	10.8	11.1	11.6	11.5
Median	7.8	11.3	9.2	11.8	11.9	11.8	10.5	10.5	10.4	11.0	11.9	11.4

In general, the responses of accelerated students to the self-rating scale showed the same trends as those of the control students. Accelerated students rated themselves in much the same way as the control students did in talkativeness, anxiety, sensitivity and

friendliness. Superior accelerated students tended to rate themselves slightly higher in adaptability. A greater degree of self-confidence was reported by accelerated students. Accelerated students considered themselves slightly more emotional than did control students. Most noteworthy perhaps was the trend shown by accelerated students having intelligence quotients below 120 to have a feeling of being easily discouraged.

To the teachers who rated twenty-four accelerated students and twenty-four control students, superior accelerated students appeared to be, in a few instances, more talkative, more excitable and more self-confident than the control students. Accelerated students seemed to be less sensitive than the control students. Teachers' ratings of the persistence, adaptability and friendliness of accelerated students were as high as the ratings of control students. The number of students rated as easy-going or extremely carefree was slightly greater for the superior accelerated students than for the superior control students. There were, however, fewer normal accelerated students than normal control students rated in this manner. The number of teachers' estimates of the social and personal development of students was too small to be statistically significant. Nevertheless, the data suggested that accelerated students were rated as highly as other students in personal and social characteristics.

The opinions of only the superior accelerated students regarding the effects of rapid promotion were considered. That acceleration was advantageous in one's school work was the opinion of forty-eight per cent of this group. That being younger was a hindrance, academically, was stated by thirty-five per cent. In the development of one's personality, acceleration was considered by fifty per cent as helpful and by forty-four per cent as harmful. Forty-three per cent of the superior accelerated students thought that being with older students had helped them socially, but sixty per cent declared that being younger than their fellows had hindered them in their social life.

Conclusions

1. The self-ratings on a scale of personal and social traits by accelerated students showed the same trends as the ratings of control students. Therefore, accelerated students considered themselves reasonably well-adjusted. To teachers, accelerated students appeared to be just as well-developed as non-accelerated students both socially and personally. However, accelerated students were not as active socially as others. They were not chosen as often to play on athletic teams or to be leaders.

Many of the Grade X accelerated students were at a disadvantage as athletes and as leaders because of their size. However, the difference in age between the accelerated and non-accelerated students might account for the social differences.

Probably accelerated students were just as well-developed socially and personally as other students of the same age.

2. That acceleration is an advantage in one's school work and in one's personality, but a hindrance in one's social life seemed to be the opinion of many accelerated students.

3. Generally, the differences in academic achievement between accelerated and non-accelerated students were not statistically significant. In the Grade IX Reading Test, the difference in the marks obtained by the superior accelerated students and by the superior control students was significant at the 5 per cent level. In the Grade IX Language Test, the difference in the marks obtained by the superior accelerated students and by the superior control students was significant at the 1.24 per cent level. In both reading and language, the non-accelerated students made higher mean scores. However, it must be remembered that the accelerated students were younger than the control students. In general, the accelerated students, in spite of this age difference, were able to hold their own academically.

Recommendations for Further Study

1. A study of the effects of acceleration on the academic progress and on the personal and social development of Grade XII students would be of value in indicating adjustments made by students two years older than those in the present study. The results of the Grade XII final examinations could be used as measures of scholastic achievement. The use of percentile rankings would be preferable to letter gradings.

2. An additional study at the University level would demonstrate whether or not there are any lasting effects of acceleration. Academic progress could be determined by a comparison of the marks obtained at the end of the freshman year by accelerated and non-accelerated students. A follow-up study could be made at the end of the year of graduation.

3. In order to allow the age factor to remain constant, a group of accelerated Grade XI students could be compared with non-accelerated Grade X students. Standardized achievement tests could be used to measure academic progress. Although the school environment for the two groups would be different, such

a study should indicate to a degree how accelerated students compare socially and personally with non-accelerated students of the same age.

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THE OBJECTIVES AND ACHIEVEMENTS OF THE SCOTTISH COUNCIL FOR RESEARCH IN EDUCATION

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The Scottish Council for Research in Education was organized in 1927. In it are represented the Association of County Councils, the Association of Counties of Cities, the Educational Institute of Scotland, the Association of Directors of Education in Scotland, the National Committee for the Training of Teachers, Training Centres and Colleges, the Universities, the Scottish Branch of the British Psychological Society, and the Association of School Medical Officers of Scotland. The Council consists of thirty-eight members. It held its first meeting in June, 1928, and was incorporated as a Limited Company in 1932.

The objectives of the Council, as set forth in its original constitution, are as follows: to encourage and organize research work in education in Scotland and, in particular, to initiate and control special investigations, making the necessary arrangements with the appropriate authorities; to receive suggestions for research; to allocate problems to suitable investigators; to finance approved investigations, wholly or party; and, finally, to authorize the publications of results and recommendations.

The Council meets semiannually. An Executive Committee of fourteen members implements the plans of the Council; The Finance Committee prepares the annual budget, allocates funds and presents accounts at stated meetings of the Council.

The operations of the Council are financed by annual grants from the Educational Institute of Scotland, Educational Authorities, and, more recently, from County Council and Counties of Cities. Grants from individual educational authorities and counties tend to be in terms of numbers of pupils. Since 1946, under the terms of the Education Act, (Scotland) the Education Department has made grants to the Council. Substantial contributions have also been received from international and national committees and organizations, usually for the advancement of a particular research project.

From the creation of the Council in 1928 till 1946 the staff consisted of an honorary director, a full-time secretary and an office assistant. In 1953 the staff was unchanged save for the addition of a research officer and two more office assistants. The Council maintains an office and technical library.

From the first the Council has recognized the conduct and publication of the results of research as its major role. Periodically it has surveyed the field of educational research for problems requiring attention. These have been arranged in order of priority, and either incorporated in the Council's program, or assigned to some other research group for study. Thus it has played an imporant role in the stimulation and coordination of research throughout Scotland. It has steadily refused to accept a role involving test construction on the grounds that this activity would require a full-time technical staff, and would direct its energies and resources toward ends inconsistent with its objectives.

The work of the Council over its twenty-eight years is of interest to Albertans. A listing of its major research efforts follows, accompanied by comments where warranted by the apparent interest or importance of the study.

1. **City and Rural Schools: A Comparison of the Qualifying Candidates,** 1938.

   This comparison revealed that both in intelligence and attainment the small country schools and the large town or city schools show to better advantage than schools of medium size.

2. **Achievement Tests in the Primary School,** 1934.

   A comparison of all the 'eleven-year-olds' in all Fife schools with the norms of an American achievement test demonstrated that the Scottish children are sixteen months ahead of American children of the same age. A subsidiary study revealed the superiority to be present at 7½ years. This advantage is attributed to the fact that Scottish children enter school a year to fifteen months earlier than American children.

3. **Age-Grade Distribution of Primary Pupils,** 1937.

   The percentage of children retarded two years or more in Scottish schools was 7.82 while the corresponding percentage of acceleration was 0.33.

4. **Time Allocation to Primary School Subjects,** 1937.

   The same study revealed 'convincing evidence' of the lack of uniformity in time allocation to the various subjects of the curriculum.

5. **Examinations,** 1932.

   Investigation of certain aspects of examinations resulted in the conclusion that there was wide divergence in the amount of time devoted to examinations in Scottish schools. In some extreme cases 15 per cent of teaching time was so occupied.

The unreliability of teacher's judgment of attainment was also confirmed.

6. **Technique for Promotion to Secondary Education, 1942.**

   The International Examinations Inquiry held under the auspices of the Carnegie Corporation of America resulted in a study of the relative merits of various procedures used in making promotions to secondary education. It was found that the most effective battery was "I.Q. + Qualifying Examination + teachers' estimates (scaled)." The order of merit of single measures was teachers' scaled marks, scholastic tests and I.Q. It was recommended that teachers might employ more standardized tests and improve their standards of marking.

7. **Allocation of Pupils to Different Secondary Courses, 1936, 1944.**

   Tests of ability in English, modern languages, algebra, geometry and science were devised for determining types of ability, on the basis of which people could be directed into the appropriate secondary school programs.

8. **Prognostic Value of the Leaving Certificate for Success at University, 1933.**

   No significant difference was found between the prognostic value of teachers' marks and marks of the Scottish Education Department for success in university examinations. The coefficients of relationship were low, due to the fact that they referred only to pupils successful on the Leaving Certificate Examination.

9. **Curriculum for the Advanced Division, 1932.**

   In anticipation of the raising of the compulsory school age, the Council agreed to investigate curriculum appropriate to pupils of 12 to 15 years of age. Thirteen panels held a total of sixty meetings, the recommendations being published in a report of the Council.

10. **Classroom Problems.**

    Basic and applied research has been conducted in arithmetic, reading, spelling and language over the years.

11. **Practical Problems in Teaching Method, 1938.**

    Study of stenographic reports of actual lessons led to the publication of general conclusions on this matter.

12. **Teaching Aids, 1940.**

    By use of a Teacher's Appraisal Form and Pupil's Appraisal Form more objective evaluation of educational films was made possible.

13. **Physical Defects.**

A group test for color blindness was prepared. In 1952 a survey of 4,000 twelve-year-old pupils in Fife was initiated with a view to discovering the incidence of deafness, the degree of loss of hearing, and the influence of varying degrees of hearing deficit on I.Q. and achievement.

14. **Mental Testing, 1932-47.**

This survey covered all 11 year old children in Scotland. A group test of intelligence of the usual verbal type was used with pictorial items for the benefit of duller pupils. The finding was that the mean I.Q. of Scottish boys was close to 100 with the girls slightly, but not significantly, less. A study of the distribution suggests that less than five per cent may be described as special pupils for whom special provision might be made. Half may be regarded as approaching subnormal, half as supernormal.

The 1947 survey was undertaken to answer the question of the anticipated decline in national intelligence resulting from a differential birth-rate. To answer this and other questions the group test was administered to the eleven-year-old group in 1947. Contrary to expressed fears the results showed a rise of 2.284 points out of a total of 76 on the mean group test score. *Social Implications of the 1947 Mental Survey* reports on the social aspects of the 1932-47 study. It reveals but does not explain the negative association of intelligence and family size. It provides evidence, for Scotland at least, that there are no marked differences in distribution of intelligence between urban and rural areas. While the differences are not significant, the mean score of the most remote and isolated districts, The Highlands and Islands, is highest; next comes the rural areas, third, the four cities, and last the industrial belt. This finding is at variance with current findings in America, and Alberta.

15. **Modification of Terman-Merrill Revision of the Stanford-Binet Scale, 1938.**

In 1938 a sub-committee was established to recommend modifications of the 1937 Revised Stanford-Binet Scale. Copies of the modifications have been distributed and are widely used today. A study of the effectiveness of the Stanford-Binet items has been made for a sample of 2,050 Scottish children from 6 to 12 years of age.

16. **Environmental Influence on Mentality, 1936.**

Three hundred children moved from slum areas to an improved

environment were tested at the time of the change in residence, and 12 months and 18 months later. Evidence was produced of a slight but detectable acceleration in the transferred group. This confirms previous studies.

17. **Bilingualism, 1942.**

Two hundred and fifty bilingual eleven year old children in the Hebrides were compared with a similar number of monoglot Shetland children by means of four group tests of intelligence, of which two were verbal and two non-verbal. The study revealed a slight inferiority in the bilingual children, which fell short of attaining significance.

The Council stands committed to a study of the educational implications of the 1947 Mental Survey. A scholastic survey for the whole of Scotland of one or more age groups with a view to the diagnosis of weaknesses in mastery of primary school processes is contemplated. There is to be a study of the distribution by counties of entrants to Scottish universities, in the effort to discover inequalities of opportunity, if any, and their causes. Finally studies of handwriting and spelling are in the planning stage.

The continuity and quality of the work of the Scottish Council for Research in Education is impressive. In large measure its success must be recognized as the result of the efforts of its first honorary director, Sir Godfrey Thompson, Professor of Education, Edinburgh University. A foundation member of the Council in 1928, he was in almost continuous association with its work until his death in 1955. He served as Chairman of the 1947 Mental Survey Committee. While the research program may be said to have arisen from the developing needs of Scottish education, the concern for precision and rigor in its execution, and the continued interest in the factors influencing the intelligence of school children must be attributed to its first director, Sir Godfrey Thompson.

A COURSE REVISION COMMITTEE IN ACTION

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"I certainly enjoyed the work . . . and how it happened to be such an easy group to work with just seems to have been a marvelous coincidence." This comment was written by a member of a revision committee on a questionnarire eliciting opinions on the group precedures used during eighteen months of committee work. In this time, members had engaged in long hours of discussion, had examined countless texts and references, and had prepared detailed written drafts of course material. The work at times had seemed extremely difficult and the discussions had exposed sharp differences of opinion. What had made this an easy group to work with? Was it just a marvelous coincidence? Was it the personalities of the members? Or was it, possibly, the fact that group participation had received a little more attention than is customary with committees of this kind?

Traditionally, curriculum development in Canada has been a process of revising courses of study and issuing official bulletins. Although recent changes[1] have increased the basis of participation by teachers and laymen, the basic frame of reference and the procedures[2] followed in most Provinces have not been radically altered. The actual work of revision is generally undertaken by a small committee appointed by the department of education and assigned the task of selecting a text-book and writing a course outline. As might be expected, this form of curriculum revision tends to place emphasis upon securing a finished product for approval and official authorization. Although there may be considerable freedom of discussion in the committee, the necessity of meeting the requirements of a centralized authority is an ever-present influence. Leadership tends to be somewhat formal and authoritarian. Group participation may consist chiefly in preparing assigned sections of the work for approval. As a result, there may be little evidence of a strong feeling of group interest and responsibility for the ultimate success of the product in the classroom. Nor is there much

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[1]A. B. Morrison, "Curriculum Construction," **Canadian Education Today.** New York: McGraw Hill Co., 1956, p. 77.

[2]The Canadian Education Association, **Procedures in the Preparation of Curricula, Report No. 69, June 1954.**

attention paid to the potential value of the experience for the members of the committee themselves.[3]

Our committee decided on a different course of action. This report describes some of the proceedings that were followed. It is not a research study. Essentially, it is a report of one observer's impressions of the work of a particular committee. In this case, specific attempts were made to observe and apply new concepts of group procedures in a practical situation. The steps were:

(1) To determine our purposes to our mutual satisfaction.

(2) To develop our own method of procedure.

(3) To evaluate the effectiveness of the procedures we used.

The results suggest interesting possibilities not only for educational research, but especially perhaps for the work of curriculum revision.

The writer, as a member of the curriculum branch of a provincial department of education, was assigned to work with a committee of ten teachers appointed to revise a senior high school course in social studies. With the approval of the members he combined his role of "consultant" with that of secretary to the committee. In this capacity he was able to relieve members of a considerable amount of routine in the preparation of materials. It was hoped, too, that this position would to some extent annul traditional concepts of authority often associated with official positions.

The following procedures were used to gather material for this report:

(1) Prior to each meeting notes were made for personal guidance, recording observations of past proceedings, and anticipating problems likely to arise.

(2) Following each meeting a detailed record of discussion was prepared from notes made as accurately and objectively as possible. Names were not used.

(3) At the conclusion of the work an informal questionnaire was completed by each member.

Notes and Reports of Meeting of the Committee

The following excerpts from the narrative account indicate the type of information collected, the nature of the problems that arose, and the effectiveness of the procedures used.

Secretary's Notes for First Meeting. This committee is composed of ten members all of whom have had a minimum of five years teaching experience. Two are younger than the others but all are experienced in the field of social studies. At least three have taken history honours . . . . We can expect a

[3]For teachers' reactions to similar situations, see Stephen M. Corey, **Action Research to Improve School Practices,** New York: Bureau of Publications, Teachers College, Columbia, 1953, p. 48.

fairly traditional course . . . . There has been some disagreement between the local associations on the wisdom of undertaking this revision. It may influence opinions. Discuss the question it if arises. Prepare suggestions for content of course outlines for use if necessary . . . .

Report and Observations of First Meeting. The first meeting was devoted to informal discussion of social studies, the content and structure of a course outline, and a variety of related topics. The following discussion is typical:

Chairman: Do we want a comprehensive outline as we have in . . . .

Member: It should not be too detailed . . . teachers attempt to cover everything . . .

Member: And then complain that the course can't be covered!

Member: What about the needs of the inexperienced teacher? Shouldn't we consider this?

Member: I like the idea of two columns, one for content, one for directing the teaching.

Chairman: I think we give too much direction . . . surely teachers have some training at this level . . . we can't do everything. Besides some of those directions in . . . are not practical.

Secretary: There are probably many . . . we did a survey once showing the number . . . who haven't had as much experience as you people. You have developed some good ideas for teaching that seem natural to you. But these are not necessarily widespread (illustration of some undesirable but not uncommon practices).

Member: We need a happy medium . . . not too much philosophy!

Member: That's just window dressing. Teachers don't read it. Keep this to a minimum. (agreed)

Secretary: Perhaps the fault lies in the way we state it.

Member: Could we look at other courses? (the secretary was asked to provide a library of material)

Discussion continued in this vien for some time, then,

Chairman: Well Mr. Chairman . . . I mean Mr. Secretary . . . where do we go from here?

Secretary: Suppose I summarize for the record some of the suggestions you have made. This we could amend at any time but it will help to get something done. (Summary read)

Chairman: How about each one preparing a brief outline of his ideas of what this course should include for the next meeting (agreed). When should we meet? (Note one member suggests meeting at his home.)

Secretary: Before adjourning, I'd like to raise a problem that may be worrying some of you. Some of you may be members of associations that have expressed disagreement with the plan to revise this course. Does anyone feel he is being placed "on the spot" by being asked to act? (There was considerable discussion on this point.)

Chairman: I went into this question with the department and others (teachers) . . . Many of us would prefer to see another course but failing that it seems wise to do something about this one. (There was general agreement with this position.)

Secretary's Notes for Second Meeting. Not a great deal was produced at the first meeting. Note that the discussion "wandered" a bit but this is probably necessary . . . Members of the committee have a good sense of humour which may be an asset . . . Note that Chairman seems to feel that I am in charge. Probably I should refrain from participating . . . keep more in the background . . . difficult, when you're interested. . Some explanation of the selection of members might help in offsetting any factors causing lack of harmony. Members are from districts geographically removed. They

are also from local associations which have not always agreed. This may be a factor here . . . Relationships fairly formal but good.

Report and Observations of Second Meeting. An interesting discussion arose concerning the purpose of the course:

Member: As an introduction to this course I think we have to state what we are trying to do . . .

Member: The answer to that is we were told what we should do and there's not much we can do about it. Isn't that right Mr. Secretary?

Secretary: I suppose you're right in a way. Could we perhaps approach it a little differently. You may recall what led to the appointing of this committee . . . various proposals made . . . considering the total curriculum it was not possible to accept some . . . but I don't think anyone was too happy with the present situation. Hence the general directive. Now, there may be some value in getting our own ideas clear on what should be done within this general directive . . . what should a course in modern world developments attempt to do? What values could it have? . . . If our conclusions are not quite in line with our directive, we'll change the directive! (Laughter)

There was considerable discussion here. A good spirit existed. The whole process seemed to be that members were reaching a concensus concerning the purpose of their work. Each member, including the chairman, presented his outline of what this course should be and had the opportunity to explain it. Each was subject to slight critical comment but no attempt was made to settle disagreements at this stage. A considerable time was taken but it seemed worthwhile.

Secretary's Notes for Third Meeting. Part of the value of the previous meeting may be due to the fact that it was held at the home of one of the members. Opportunity for social conversation afterwards contributed to good relationships . . . Problem at this meeting will be one of deciding what to do and how to go about organzing the work. My experience with previous committees indicates two or three procedures that could be used. Should I present these? It might be better if members tackle the problem in their own way. Make suggestions only if needed to prevent getting "bogged down" on procedure.

Report and Observations of Third Meeting. Meeting opened with further reference to the outlines previously prepared . . .

Chairman: Our problem seems to be which of these do we accept and what do we do with it? I made an analysis which shows that none of us is very far apart (passes out chart). (Discussion)

Member: Our problem seems to be how to select . . .

Secretary: In terms of what we are attempting to do?

Member: Yes. Although that doesn't seem to help much.

Member: I suggest we agree on what topics should be taught and then organize them into units with specific suggestions for teaching them. (Discussion of topics)

Chairman: Where do wo go from here? What do you think Mr. Secretary?

Secretary: It is one possible approach. I wonder if anyone else has a plan of how we go about this?

Member: Mr.———— and I didn't think much of the outline we prepared for the last meeting so we took copies of everyone else's and "plagiarized" to make a new one. It's bound to be good! (Laughter) (Copies distributed and discussed. Content, method organization and details were discussed and suggestions made for modification. Group seemed to get lost in detail. Meeting adjourned and continued on the following day.)

Chairman: I see the Secretary has a lot of notes on this. They will be distributed to members. It seems to me we could accept this outline as a

framework. How do the rest of you feel about it? (Agreed) What should we do now?

Member: We might each take a section and expand it.

Member: Possibly we could work in pairs?

Chairman: Is this acceptable? (Agreed. Members took sections in which they were most interested and agreed to prepare expanded drafts for next meeting.)

Secretary: Just by way of comment, I wondered how you were going to deal with this problem . . .

Member: So did we! (Laughter)

Secretary: It was most interesting. There are no "experts" in this business. We have to work these things out and that takes time. It might be an idea to keep in mind the discarded materials which may contain good ideas. When you realize that what you do here will affect what will happen in every grade ten classroom next September you will appreciate the need for as many good ideas as we can get.

Secretary's Notes for Fourth Meeting. One member seemed reluctant to go along with group opinion on organization at the last meeting. He may feel he didn't get a chance to explain his approach fully. (This is verified later when he completed the evaluative questionnaire.) Perhaps his difficulty lies in explaining clearly what he wants. Perhaps the others are unconvinced. He is from another district and seems younger than the others. This may account for his attitude. When it comes to group discussion of each expanded topic there may be difficulties in relationships. He and one other are working on a very difficult section. On the other hand, he is liked and respected as a person. There may be a place for giving an established set of professional criteria to the group to use as a basis for the critical examination they must make sooner or later e.g., (a) significance of content to field of knowledge (b) needs of pupils and (c) test of survival, difficulty, etc. This would place discussion on an objective level.

Report and Observations of Fourth Meeting. Assignments had previously been sent into the Secretary and copies had been made for all members. The meeting was devoted largely to discussion and criticism of topics as they were developed. Two such topics were revised. The Secretary took down the revisions as suggested.

Prior to discussion the Secretary gave a brief outline of criteria' for selecting subject matter. It may have been of some value in bringing out the following:

Member: I would suggest asking pupils to contrast their life today with what it was in medieval times . . .

Member: Students might debate or discuss question, "Is the Renaissance spirit alive today?"

Member: It seems to me we should use the art and music departments here.

An interesting indication of group spirit was noted in the discussion of the Reformation.

Member: I feel we have an unbalanced treatment indicated here. How does ———— feel about it?

Member: It seems quite reasonable. I don't see much objection to it.

Member: Well, I think we should reword it slightly so that it will not offend religious beliefs.

Member: Reference should be made to the reforms within the church.

(There was some evidence of a feeling of impatience as discussion continued.)

Member: We just can't teach everything. Why not leave it and let the teacher add whatever he wishes?

The group was persistent. The Chairman was careful to call for opinions, particulary from those who did not enter discussion too freely.

Secretary's Notes for Fifth Meeting. This will be one of the more difficult meetings. The topic scheduled for discussion introduces some difficult and new material. Those who prepared it have already experienced some disagreement. Conflict of personalities will complicate matters. What should one do to avoid this conflict? It takes mature people to disagree properly and constructively. Probably desirable to interject suggestions designed to keep discussion on professional level.

Report and Observations of Fifth Meeting.

Chairman: This topic is much too complex . . . and too dificult . . . ideas are far too abstract for these pupils (reads sections).

Member: (author) Could we review the whole topic and its development first?

Chairman: But the whole thing is too abstract.

Member: Why stress geography?

Member: All I can do with my classses is . . . (describes procedure).

Member: Shouldn't we keep the same approach we've suggested for other topics—begin with definition . . . (agreed)

Chairman: I can't go along with the idea of teaching this material about South America . . .

Member: But South America is probably of equal importance to Europe . . .

Secretary: I think we're all on the wrong track here. We're just organizing adult material in an adult fashion without any regard to the purpose or the pupils. We're too prone to take the material we learned, we were interested in, we enjoy teaching it. How much is remembered? How much is understood? Or of any value?

Member: Wouldn't some of these criticisms apply to everything we've done?

Secretary: You're right. I'm exaggerating. But I do feel that we should try to build on what has been prepared.

The discussion continued until as the Chairman put it "the law of diminishing returns set in." However, the group simplified and reorganized the topics to the satisfaction of the majority, at least. Following this meeting, refreshments were served and the group relaxed.

Secretary's Notes for Sixth Meeting. The previous meeting was probably the least successful so far in terms of relationships. The chief weakness lay in the fact that strong opinions and feelings entered into the discussion. On the other hand, there is no question but that the revisions made were good. Now to try to build up morale again!

Reports and Observations of Sixth Meeting. Opened with remark that authors of next topic had withdrawn it and made another because they were "afraid of what might happen to them." (laughter)

Routine of discussing and suggesting changes was carried on amicably. Several practical suggestions were made for guiding teaching.

Chairman: Do you think we can get into discussion of the depression?

Member: We should be able to give pupils some idea of what it was. After all, this is a social studies course and we don't seem to be paying much attention to the economic aspect . (Members agreed.)

Secretary: This seems a sound comment. How would you teach it?

Member: Well, I would explain what it was and why is occurred . . .

Concluding Meetings

The same procedure as noted above was followed for all meetings. It was observed that as the work continued morale rose. The use of first names, and the telling of "stories" or reminiscences were frequent. Two members received new appointments and were enthusiastically congratulated. Meetings were held more frequently in private homes.

A final draft of the whole course was prepared by the Secretary. It was pointed out that everything in this draft was the work of the members of the Committee. This "clerical job" relieved committee members of a rather tedious process. It looked quite impressive and all members seemed to feel proud of the fact that they had made definite progress. The draft was again reviewed and further suggestions were made.

It seemed evident to the Secretary that the work was rapidly nearing completion although this was not generally recognized and the final meeting came as a bit of a surprise to some. At his suggestion one meeting included a group dinner at department expense which seemed to add a good touch to relations between teachers and department. This turned out to be the final formal meeting.

Evaluation

Validity of any evaluation of the group processes and procedures undertaken in this study is limited by two factors. The first is the lack of objective criteria and the consequent lack of data on which to base the evaluation. The second limitation common to many educational "experiments" is the difficulty of placing oneself outside of the project and maintaining a completely detached viewpoint. Nevertheless the idea of evaluating seems sound. It was attempted in this case and some of the results may be worth mentioning. These are the opinions expressed by members of the Committee on an informal questionnaire summarized as follows:

(1) Purpose:
   (a) All members agreed with the statement that "within the general purpose . . . we developed and agreed upon some ideas of our own as to what our purpose should be."
   (b) All members agreed with the statement that "what we were doing was essentially worthwhile."

(2) Organization and procedure:
   (a) Time, place, frequency of meetings, size of committee, were considered adequate by six out of ten members. Those disagreeing offered suggestions for improvement.
   (b) No member felt that the presence of a departmental official "resulted in a tendency to dominate or restrict the work."
   (c) Nine members felt that the time the committee spent in working out its own approach and procedure was an effective way of functioning.
   (d) Nine members considered the morale of the Committee was "generally excellent;" one considered it "reasonably good."
   (e) Nine members felt that they had sufficient opportunity to present their ideas; one disagreed.

(3) General reaction:
   (a) All members felt that to some extent they had changed their opinions as a result of discussion.
   (b) All members felt that they had gained something from the experience of working on this committee.
   (c) Specific comments:
      (i) "how it happened to be such an easy group to work with just seems to have been a marvellous coincidence"
      (ii) "we should have held longer meetings to permit the discussion of seemingly unpopular ideas"
      (iii) "our committee gained much from the wisdom of 'tried hands' and from the vigor and enthusiasm of new members"

Conclusions

It is the opinion of the writer that the enthusiasm and interest shown by all members was due in part to the fact that, contrary to some traditional procedures, a definite attempt was made to involve the group in the whole problem and to avoid "editing" or censoring their work. The Committee was made to feel that it had the complete confidence of the Department. Furthermore, the fact that the mechanics of organization (i.e. into sub-committees and individual reports) were developed by the group in the process of carrying out its objectives seemed to produce more originality and creativity in the work undertaken than might have been the case with more stereotyped procedures. Some of the techniques for classroom teaching were ingenious and practical. One weakness may be a lack of professional references to principles and method. Perhaps a curriculum bulletin is not the best place for these. The course itself might be considered largely traditional in concept and organization.

It was personally gratifying to note that the attempts to provide some assistance from a curriculum worker were apparently well received. The danger in having officials present is two-fold: first, that unconsciously or otherwise their experience tends to direct the group at times when it should work out its own problems; second, that personal liking or respect for the official can becloud the independent critical judgment of the individual. The idea of having a department member act as secretary was effective, first in "toning down" any "prestige" influence of any official and second in relieving the Committee of much burdensome clerical and mechanical work. The latter resulted in greater attention being given to the more creative aspects of the work.

Attempts to improve morale appeared to be highly successful. Each of the six members expressed the opinion that the morale of the group was either reasonably good or generally excellent. It is interesting to note that morale is not a static thing. It was not consistently high. But having confidence in all members and respect for each individual does much to improve the attitude to work.

So far as inservice growth is concerned, it has already been noted that we sometimes lose sight of the potential values that participating in a course revision can have for individuals. In this case, all members considered they had gained from the experience. Probably some attempt should have been made to obtain more specific information on this point.

It will be evident from the foregoing that no valid conclusions about curriculum revision work could be drawn. This account may

suggest ideas for more carefully planned studies. The experiences of the writer tend to support the following opinions of those who have studied group procedures:

(1) It is important for teachers and leaders to perceive one another as human beings rather than as teachers and administrators.[4]

(2) Close observation and intelligent questions during the course of meetings are valuable in revealing errors and their origins as well as improvements and their reasons. A full running account of what happens would be most helpful.

(3) The increase of teacher participation in curriculum revision, and the fact that this usually takes the form of group activity, suggests that curriculum workers require not only a sound knowledge of curriculum but as well much skill in working with groups.

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[4]George Sharp, **Curriculum Development as Re-Education of the Teacher,** New York: Bureau of Publications, Teachers College, 1951, p. 112.

OBSERVATIONS ON SCIENCE 10 AS AN INTEGRATED COURSE IN PHYSICAL SCIENCE

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Functional vs. Traditional Science

Traditional Aims of Science Teaching

Traditionally, high-school science teaching has had two related basic purposes, to train the mind, and to prepare for college.

The school set out primarily to provide an effective mental discipline. In this task it was greatly influenced by a theory in which the mind was held to be made up of discrete parts or faculties, each requiring a peculiar and vigorous activity for its development. So widespread was the acceptance of this concept that in many older surveys of teacher opinion the disciplinary values received first recognition.

Thorough subject matter became therefore an indispensable tool in education; "its very difficulty was valuable as a discipline." In this regard, the study of the sciences was held to possess particular value:

> . . . They (the sciences) provided unique opportunity for mental discipline by training the faculty of observation, promoting the concentration of thought and energy and providing sense training through the manipulation of materials.[1]

Attempts to meet the second purpose of high school teaching, preparation for college, served greatly to re-inforce the disciplinary claims. Designed to meet university-entrance requirements, both subject matter and methodology in the high schools were rigidly prescribed. Subjects were highly specialized, technical and difficult. Detailed laboratory work was stressed for training in careful observation and precision. As all students were assumed to have the same mental faculties, little concern was felt for individual needs. Instruction was the same for all students, college-bound or not, because the discipline suitable for college entrance was thought to afford valuable training for all.

Reaction Against Traditional Aims

For the past few decades critics have brought these twin supports of traditional teaching under heavy fire. Mental discipline was dispatched to the limbo of outmoded theories and the methods it once justified placed under severe examination. Their survival was

[1]Progressive Educational Association, **Science In General Education**, p. 8.

soon considered evidence of "discrepancies between the best thought in education and current practices in the teaching of science."

With its disciplinary undertones discredited, the preparatory aim fared little better. The demands of university entrance were labelled pernicious. They had forced the high school to neglect many worthwhile educational values through undue pre-occupation with specialized science. Subjects too often were reduced to "a confused mass of abstract technical facts and principles, bearing few discernible relationships to actual life."[2]

So effective were these criticisms that educators soon became increasingly sympathetic to the need for tranferring a subject from a scholastic discipline or a formal college prerequisite into a means of direct education for the activities of life. To this end, science content was selected for its bearing upon the facts, experiences and skills needed in everyday life; and the enrichment of generalization related to common human activities became a major aim of science teaching. A new concern was felt for the ways of thinking and attitudes of mind associated with the scientific outlook. These non-factual or 'intangible' objectives became important enough to transcend other objectives in science instruction.

Education for effective personal adjustment had become a popular goal; science instruction was becoming 'functional'.

Some Implications of Functional Science

Integrated Physical Science—A Generalized Course

Certain attempts at functional science tend toward generalized courses planned to meet the more immediate science needs of the common users of science. This trend has resulted in a decreased emphasis upon "specialized science courses in the senior high school," accompanied by efforts to extend "the general science point of view to the upper grades."[3]

These innovations have taken some interesting forms. In some cases, each branch of science is reviewed in turn, as in general science. Other courses draw upon two or more of the specialized sciences to 'integrate' into one course the pertinent facts and ideas of each. This is a favoured method. It is also a significant one, for it represents an important development in science teaching, namely 'fused' or 'integrated' science.

The integrated course in physical science, then, discards as such the divisions of specialized science. It goes beyond the bounds of

[2]North Central Association of Colleges and Schools, **High School Curriculum Re-Organization, p. 239.**

[3]G. W. Noll, **The Teaching of Science in Elementary And Secondary Schools, p. 145.**

any one subject and involves a re-organization of subject matter and concepts drawn from the whole science field.

Claims Made for the Integrated Course

Freed from the requirements of highly specialized subjects, teachers may be better able to concern themselves with important non-factual values of their instruction. The bearing of scientific discoveries upon personal and social problems, the development of effective problem-solving abilities, the growth of desirable attitudes, may all receive a vigorous re-emphasis. At any rate, such claims have been made.

Noll commends a point of view broader even than that of the chemist, zoologist or physicist. The 46th Yearbook recognizes "superior possibilities of a composite physical science over the separate traditional chemistry and physics courses in contributing to the aims of general education."[4] Finally, of interest to Alberta teachers is the official view from the Curriculum Guide. Here, the integrated approach is justified as being "in keeping with the contribution which science education may make to all students,"[5] not just to those intending to become science specialists.

Organizing The Integrated Course

Educators, however, now face a difficult task. Of all the ways of combining diverse materials into one coherent course, which way will prove the most effective?

Some courses orient their content around a unifying theme which may be consumership, health or safety. Others chose certain basic principles of science. This latter method, approved in 1932 by the 31st Yearbook, has received impressive support. Noll agrees that it "has the greatest possibilities of success."[6] Further approval comes from the 46th Yearbook which states: "The content should be planned so as to develop concepts and pricinciples important not only in physics and chemistry but also in other branches of physical science, namely, geology, astronomy and meteorology."[7] Finally, in Alberta, this method was selected as most suitable for Science 10.

But merely integrating content will not of itself produce an effective course. If the aims of functional science are to be met, careful selection of materials is essential. In this regard, curriculum makers are warned to keep two considerations in mind. First, the sole standard for selecting materials is their ability to aid adjust-

[4]**N.S.S.E., Forty-Sixth Yearbook,** p. 191.
[5]Alberta Department of Education, **Curriculum Guide for Science 10,** p. 6.
[6]Noll, **op. cit.,** p. 120.
[7]**N.S.S.E., op. cit.,** p. 45.

ment in the concerns of everyday living. "No subject matter can be justified solely on the ground that it is 'good science' of a traditional sort or because it can be 'presented' in the classroom with a minimum of effort and planning."[8] Second, the course must not be made too easy. Some previous courses, particularly those which have omitted laboratory work, have been merely "on the level of effortless entertainment."[9] Integrated physical science must not become a watered-down 'snap' course.

Suitability of Generalized Courses

Educators consider the generalized course adequate both for students not going beyond high school, and for those college-bound without scientific interests. This assurance is strengthened by an increasing "disposition of colleges to recognize the physical-science course as a bonafide college entrance unit for the nonscience major."[10]

There is no such agreement, however, regarding its suitability for those proceeding to college specialization in science. The 46th Yearbook cautions that adequate provision for early specialization of selected individuals is a 'must'. Recognition of this fact has created a tendency in some quarters:

> . . . to believe that the courses in physics and chemistry should be retained much in their present form but offered only to those pupils who plan to go on in some field of science as a profession. This would then leave the course in physical science to take care of the functional needs of the young people not specializing in science[11]

Another plan offers a closer compromise between the claims of both functional and specialized science. Tower Hill School, Wilmington, Delaware, uses fused physical science as a basis for specialized grade XII courses in physics and chemistry. The twelfth year consists of two equal sections, one of chemistry and the other of physics. In preparation for this, the fused course is taken in grade XI. Proponents of this scheme contend that it "prepares students for college entrance with the same general background in science as would be obtained from one full year's work in physics and another in chemistry."[12]

In Alberta a somewhat similar practice is used.

Such programs are interesting as attempts to meet the challenge of the 46th Yearbook: "If, however, physical science is to realize its full potentialities, it must be made to serve both as a 'college-preparatory' and as a terminal course."[13]

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[8] **Ibid.**, p. 192.
[9] **Ibid.**, p. 46.
[10] **Ibid.**, p. 191.
[11] E. D. Heiss, E. S. Obourn, and C. W. Hoffmann, **Modern Science Teaching**, p. 69.
[12] Progressive Educational Association, **op. cit.**, p. 477.
[13] **N.S.S.E., op. cit., p. 46.**

Implementing Integrated Science in Alberta

Science 10 may be considered the first major step towards a functional science program in Alberta for two principal reasons. Firstly, it was designed to replace entirely the traditional specialized sciences of grade X, (chemistry 1 and physics 1). Secondly, it was the initial step in a proposed revision of the entire high-school science program.

Some insight into the construction and aims of the generalized courses in science is obtained by reviewing the stages of their development. As Science 10 is part of a larger program, we have sketched, in general outline, the overall picture without, however, losing sight of Science 10 itself as a major concern.

Implementation of the Integrated Program in Alberta

In November of 1947 a sub-committee of the High School Curriculum Committee, set up for the purpose of reviewing the aims and organization of secondary science, was directed to prepare a plan for a sequence of units in high-school science. This sub-committee arranged for discussions among teachers regarding the nature of any proposed changes. In 1949, encouraged by "evidence of a more receptive attitude toward integrated science courses in the high school"[14] among many groups of Edmonton teachers, the sub-committee went on record as favouring:

1. The principle of integrated courses in science as best meeting the needs of most students in grades X and XI.
2. The possibility in Grade XII of either continuing with a fused course, or of branching into the specialized fields of physics, chemistry or biology.
3. The planning of courses to develop concepts and principles important to all branches of science.

At this point, the sub-committee anticipated future difficulties. The major problems of organizing materials and of gaining teacher and public acceptance for the revised courses were recognized. The important part which the basic text plays in the success of any course was stressed along with the vital need for a text which incorporates the ideas of fused science.

With these danger points in mind, the sub-committee laid plans for the tentative organization of a new course.

By April of 1950 a proposed plan for the reorganization of all high-school science was ready. Composite courses in physical science were proposed for grades X and XI, to lead to either a third

[14]Alberta High School Sub-Committee on High School Science, **Minutes of Meetings for 1949-1951, February 25, 1949.**

fused course in grade XII, or to the specialized courses in physics and chemistry. Separate courses in biology were proposed for grades X and XI as a prerequisite to the grade XII composite course only.

Justification was found for these new physical science courses in their purposes "to acquaint the student with the concepts and principles necessary to his understanding of the world in which he lives."[15] They were to stress the attitudes and skills of science useful in daily living for meeting the demands of intelligent citizenship.

At is point a trial course, organized on the unit plan, was taking definite shape. The units had been tentatively named, and their outlines were well under way. After completion, this course was introduced into the grade X classes of several schools on an experimental basis.

By February, 1951, the sub-committee was also concerning itself with the construction of an integrated grade XI course, as well as with the matter of implementing both the grade X and XI courses officially. The securing of an adequate basic text, the preparation of a booklet on the aims of generalized science, and the gaining of teacher support were problems receiving attention.

When the trial course for grade X came up for review in October, 1951, favourable response from several of the trial schools was noted. A new unit, "The Nature of Matter", was added as background for grade XII chemistry. The search for a basic textbook ended with the selection of *Physical Sciences for Canadian High Schools* which was deemed suitable after suggested revisions.

By December of the same year, after provision had been made for continued evaluation and revision, the trial course was authorized for schools beginning in September of 1952. At this time, too, the proposed grade XI course was outlined in rough for its trial.

The integrated course designed for grade XII, having received university opposition, has not been instituted.

In summary, the interesting points are:

1. The attempts to gain teacher opinion of and approval for, any new course.
2. The concern with the basic textbook as an important foundation for the successful teaching of a course.
3. The desire to create a functional course, i.e., one related to the concerns of citizenship.
4. The concern with important principles and concepts as a focal point for the organization of materials.

[15] Ibid., April 1, 1950.

Science 10—Nature and Aims

A close inspection of The Curriculum Guide For Science 10 not only gives us a clear picture of the organization and objectives of Science 10, but reveals as well the extent to which this course has incorporated the philosophy of functional science.

Objectives and Organization of Science 10.

The following summary statements are derived in the main from the "Curriculum Guide for Science 10", Alberta Department of Education.

1. Science 10, as a course in physical science, "implies a re-organization of subject matter and concepts drawn from the whole science field." This procedure is justified because "in keeping with the contributions which science education may make to all students, this organization of subject matter is deemed most suitable."
2. Science 10, as a functional course, proposes to link the facts of science with the concern of life in a modern society. "The education of youth must provide a basis, not only for understanding and attacking problems within our society, but also for developing some insight into the role of science in the lives of young people."
3. To this end, the materials of Science 10 are "organized to develop important concepts" from various specialized sciences to form an integrated course.
4. Science 10 considers facts important, but they must be used to "achieve all the objectives of science education," of which factual knowledge is only one. "Science education must develop habits, attitudes and understandings, over and above the facts of science."

   At this point, we note a concern with the non-factual or 'intangible' outcomes of science instruction.

The Teaching of Science 10

1. Science 10 consists of six units, each one dealing with a basic theme. The units are:
   (1) The Nature of Things.
   (2) The Earth.
   (3) Temperature and Heat.
   (4) Weather.
   (5) Fire and Fuels.
   (6) Power from Combustion.

2. The materials of each unit have been selected to contribute, when properly presented, to a major concept. As a guide to teachers, a great number of specific procedures are suggested as a means of developing a number of related understandings. These, in turn, lead to the generalizations on which the major concept is based. A list containing understandings, generalization, and the majors, concept, is clearly presented for each unit.
3. Laboratory work is considered to have several functions. Making the student familiar with materials and equipment, and enabling him to gain skill in their use is one; clarifying facts and principles is another. Special emphasis, however, is placed upon the suitability of experimentation for developing problem-solving abilities. Teachers are urged to give these abilities special concern in their laboratory work, and to encourage their transfer to "new and meaningful situations." Thus, experimentation and demonstration are directed "to achieve some purpose above and beyond the activity itself."
4. Teachers are directed to give attention to the use of clear and precise expression through regularly assigned and corrected written work.
5. Evaluation in Science 10 has a broad scope. It should act as a corrective to the teacher in the sense that it indicates how effective his teaching has been. For the pupil, it must appraise his growth in all directions consistent with the objectives of the course. Teachers are cautioned against testing for mastery of facts alone. They must not neglect the "more difficult, but equally important" tasks of testing "habits, skills, understandings of concepts and principles, and attitudes." As a guide in this activity, they are referred to Heiss' *Modern Methods and Materials for Teaching Science.*
6. No specific directions regarding the use of the basic textbook are given. A fairly extensive list of references is presented, however, of which the basic text is considered primary. It is thus implied that teachers will feel free to use one or more sources, as the occasion demands.

Place of Science 10 *in Alberta High School Science Program*

The physical science courses in grades X and XI are deemed to have a two-fold function in that together they are designed to provide the following:

1. A two-year science education of a type suited to all students.
2. A basis upon which any student may undertake grade XII

science courses, and thereby satisfy university entrance requirements.

Such an arrangement is designed "to provide science education suited to all, as well as to equip those with special ability to proceed with more advanced science education."

Science 10 in the Classroom—A Survey and its Results

Some knowledge of two factors is desirable: conditions under which the course is being taught, and teacher reaction to its basic aims. To gather information on these matters, a questionnaire was distributed to a substantial number of Science 10 teachers. Despite this method's shortcomings, the writer was able to set down several general conclusions which, in turn, have led to a number of related recommendations. Neither conclusions or recommendations are absolute and final. They do, however, represent rough indications of possible strength and weaknesses in the course's classroom effectiveness. As such, their use as starting points in any personal or official evaluation may be helpful. To this end, the more important are listed below.

Conclusions

1. There is some evidence that a great many teachers view the present course in Science 10 unfavourably. Criticisms involving the related charges of generality, lack of challenge, repetitiousness and superficiality appear persistently, and are not counterbalanced by similar expressions of commendation. It is difficult, therefore, to ignore the possibility of Science 10 being a somewhat weak course in integrated physical science.
2. The high standards of professional preparation demanded, in the current literature, for teachers of high-school science are not being met in a fairly substantial number of cases. This situation is especially noticeable where Science 10 is being taught by teachers trained in non-scientific fields.
3. While many specific qualities of the basic textbook receive general approbation, a large majority of teachers consider the text superficial, unchallenging, and poorly supplied with stimulating questions and problems. In this regard, the principle criticism of the basic textbook parallels the criticism of the course in general. This may be a most significant point in view of the Sub-committee's concern with the need of a basic textbook as the basis for a successful course.
4. In general, the basic textbook is not used slavishly. Most teachers reorganize and supplement its content in varying degrees.

5. Certain deficiencies in facilities and equipment appear consistently. Of these, an inadequacy of laboratory facilities and materials may prove the most serious.
6. Evaluation in Science 10 appears to be particularly vigorous with regard to formal testing. Most teachers, moreover, supplement formal factual testing in various degrees with other means of appraisal, the results being included in the year's mark. The conscious evaluation of intangible outcomes concerns three-fourths of the teachers although there is some intimation that the methods used may often lean to the casual and unsystematic.
7. Most teachers experiment and demonstrate frequently, with a lesser number permitting at least a fair degree of pupil participation. Laboratory work is carried on for a number of conscious purposes, notably the clarification of scientific principles. Performance on experimental work also serves as an important supplement to formal testing in the evaluating program. There is reason to assume that the potentialities of experimental work in the developing of vital problem-solving abilities are not being fully utilized and that the laboratory programs of certain teachers are somewhat restricted by lack of adequate time or facilities.
8. There is strong adherence to teaching primarily for mastery of content with a large minority of teachers taking this position. Nevertheless, over two-thirds of all teachers do have some deliberate regard for the non-factual outcomes, either as a primary or secondary concern in their teaching. The remainder tend to ignore the intangibles as such in their teaching. A good majority of teachers, including many who do not directly teach for intangible outcomes, attempt, nevertheless, to evaluate their growth. There are indications, therefore, of a certain lack of unanimity among teachers regarding the place and the practicability of teaching and evaluating the non-factual objectives.

Recommendations

1. Greater efforts should be made to assure that, as far as possible, only those properly equipped as teachers of science are placed in charge of Science 10 classrooms.
2. Greater efforts seem necessary to remove deficiencies of equipmen and facilities. Some, or all, of the following may be helpful:
   (a) An official science-room inventory, to be filled in by all science teachers, would pin-point specific shortcomings as a guide for the teachers concerned, as well as give the Department of Education an accurate picture of the situation.

(b) An official catalogue listing suitable equipment, its approximate price and availability, would enable teachers or school officials to secure more readily any required item.

(c) To meet the problem of inadequate libraries, a similar catalogue should be prepared for those attempting to remedy this deficiency. A system of "package deals", may prove effective. Parcels of suitable books, of various sizes and prices, according to the needs of each school, could be prepared under the guidance of the Department of Education. Each package should include subscriptions to two or more suitable scientific magazines.

(d) A section of the Curriculum Guide, listing methods of creating a scientific atmosphere in the classroom, would be a boon to the conscientious teacher, particularly if he is using an ordinary classroom. This section should include directions for the best use of bulletin boards, charts, etc.

(e) Some sort of specific directions should be given to teachers hampered by inadequate laboratory facilities. These directions should concern the best use of available space, effective improvization, and related matters.

(f) Some sort of official science kit may help to overcome the shortage of laboratory materials. These packages would include basic materials for schools of various sizes.

3. Attempt to direct teachers somewhat unconcerned with clear, deliberate teaching for intangible outcomes should be made by:
   (a) setting down more graphically in the Curriculum Guide the specific nature and value of non-factual outcomes.
   (b) stressing more vigorously that these outcomes will most likely appear if they are deliberately taught for.
4. The Curriculum Guide should include a section on definite methods of organizing materials for instruction in the intangibles. Subject matter from the course might well be used for this purpose.
5. The need for purposeful evaluation of intangible outcomes seems to require emphasis. In addition, a number of ready and relatively specific methods of evaluation should be listed as a guide to all teachers, and particularly to those whose evaluation may be somewhat casual or uncertain.
6. More specific guidance regarding use of laboratory work as a means of training for problem-solving abilities seems in order. Methods of encouraging the use of the scientific method in The Curriculum Guide's " new and meaningful situations" would be

particularly helpful to those teachers having difficulty in this respect.

7. As the course outline and the basic textbook share responsibility for any charge of weakness made against Science 10, they may be profitably reviewed together in relation to the following questions:

   A. *The Course*:
      1. Is it too long and too general?
      2. Does it repeat too many grade IX materials?
      3. Are many sections too easy?
      4. Is it doing its full share in providing a proper basis for grade XII work?
      5. Are its materials selected and organized to best provide a highly effective course in integrated physical science?

   B. *The Basic Textbook*:
      1. Are its materials organized most effectively to:
         (a) provide efficient integration of subject matter?
         (b) encourage ready development of major concepts?
         (c) encourage substantial growth towards the non-factual objectives of science teaching?
      2. Do the problems and questions generally lack challenge?
      3. Is its content often presented in too superficial and unchallenging a fashion for grade X?

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THE EVOLUTION OF THE MATHEMATICS PROGRAMME IN ALBERTA HIGH SCHOOLS

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The Early High Schools (1889-1912)

In 1889 the high school made its first appearance in that part of the North West Territories now known as Alberta.[1] The influence of Ontario in the curriculum was conspicuous: a fairly narrow classical curriculum in which mathematics was prominent. The academic content of the programme was suited to the small, relatively select, group of students registered in the secondary schools.

Much of the early emphasis on mathematics was due to belief in the concept of formal discipline. It was commonly accepted that the training gained in studying mathematics would automatically be carried over into all other activities. Locke, one of the early exponents of the theory, believed that the prime purpose of education was to make man a reasoning creature and that no subject could develop the ability to reason better than mathematics.[2] At the turn of the century many psychologists were beginning to test experimentally the validity of the claims made for formal discipline but as yet their influence had not been felt in the classroom.

In 1893 Dr. D. J. Goggin was appointed Superintendent of Education for the North West Territories. In 1902 he thoroughly revised the Programme of Studies for the Territories. "It is the needs of the pupils," said he, "and not the entrance requirements of colleges and professional schools that must shape the high school course of study."[3] But the 'needs' of the average student evidently included high school mathematics. Algebra, geometry and arithmetic were taught in Standards VI, VII, and VIII at the beginning of the period. Trigonometry later replaced arithmetic in Standard VIII.

The early textbook in geometry was MacKay's *Elements of Euclid.* Dr. Goggin recognized that if memorization of proofs was to be minimized, the pure logic of Euclid required mature intelligence. In an effort to compensate for the difficulties encountered by many students he introduced intuitive geometry as a preliminary to the logical elements of demonstrative geometry. He commented:

> At first the pupil should discover geometrical truths through measurements, drawing, construction, and superposition rather than through logical

[1] In 1889 a high school was organized in Calgary with Mr. James Short as principal. See **Calgary School District, Province of Alberta, 1885-1935.**

[2] Claude H. Brown, **The Teaching of Secondary Mathematics,** pp. 56-84.

[3] **Report of the Council of Public Instruction of the North West Territories, 1900, p. 26.**

> demonstration. In demonstrations, clearness of reasoning, accuracy of statement and elegance of form should be emphasized. The subject matter of each lesson should be considered in its relation to life, i.e., the actual occurrence in nature and in the structure of machines made by man, . . . and the application of the propositions to the ordinary affairs of life should be the basis and the outcome of every exercise.[4]

His adherence to this line of thought appeared to influence the geometry examinations. For example, in 1900, this question was asked on the third class test on Euclid:

> 3. (b) A farm lies between two roads not parallel; determine when possible, where the owner should locate his house, that it may be equally convenient to each road.[5]

An effort to frame questions to determine understanding of basic principles was apparent. Records available seem to suggest, however, that geometry examinations reverted to the more formal type after Dr. Goggin resigned in 1903:

> 13. (a) State definition 5, Book V and illustrate it algebraically.[6]

Baker's *Geometry for Schools* was introduced in 1912, the year in which the Standard System was replaced by the Grade System. It was used as the textbook in grades IX to XII, and gave indication of the first partial break with Euclid in Alberta. Some of the earlier propositions were simplified, some omitted, and the sequence was changed. Baker recommended that geometry should not be completely dissociated from the other branches of mathmatics studied at the same time.

Hamblin Smith's Arithmetic, which was the prescribed textbook in the first high schools, was an English textbook adapted to Canadian schools. The Preface states: "Special care has been taken to adapt the work to the wants of the business community." Highly complicated mechanical questions were common, for example:

$$\frac{\frac{1}{21} \times 5\frac{17}{23} \times 6\frac{3}{11} + 6\frac{19}{51} \times 1\frac{23}{49} \div 2\frac{5}{17} + 1\frac{10}{49}}{9\frac{16}{57} \times 1\frac{22}{23} \div 5\frac{17}{38} + 3\frac{11}{78} \times 6\frac{17}{21} \div 7\frac{21}{32}} \times 12\frac{4}{9}$$ [7]

Some of the problems bear little relationship to the experience of the students:

> No. 169 Of two stalactites hanging from the flat roof of a cavern, one is 1.02 inches longer than the other, and the shorter one increases in length at the rate of 3.014 inches in a century. Find the rate of increase of the other in order that they may be of the same length at the end of 125 years.
>
> No. 249 Two elephants which are 10 in length, 9 in breadth, 36 in girth and 7 in height consume one drona of grain; how much will be the

[4] **Annual Report of the Council of Public Instruction, North West Territories, 1900, p. 27.**

[5] **Annual Reports of the Department of Education of the North West Territories, 1900-1903, p. 90.**

[6] Province of Alberta, Department of Education, **Annual Report, 1912, p. 225.**

[7] **Hamblin Smith's Arithmetic**, adapted to Canadian Schools by Thomas Kirkland and William Scott, **1877, p. 70.**

[8] **Ibid., pp. 276, 249.**

> rations of 10 other elephants which are a quarter more in length and other dimensions.[8]

A report of the markers of the arithmetic examination papers suggests that inaccuracy in calculation and careless reading habits were the chief factors contributing to lack of mastery of this subject:

> Inaccuracy in calculation, especially where fractions enter in, is a marked feature of the work. The reasoning of the better candidates is very fair but there is room for additional training in the expression of this reasoning. Too many candidates think more of getting the answer than of presenting a logical solution in good English . . .
>
> Inability to read the questions intelligently seems a too common cause of failure. Reasoning power is good but the expression of reasoning in logical order and good English, while an improvement on last year's work, is still not up to standard . . . Neglect to draw figures is the prime cause of failure in a number of solutions in mensuration.[9]

Opinions similar to those expressed in the reports quoted above were also heard in the United States during these early years. F. Milner, for example, in the School Review of February, 1898, comments:

> Each September finds me ready to begin the review of arithmetic with my 140 or more seniors . . . My pupils are not accurate in computation, they do not hold themselves responsible for such accuracy; they have no habit of persistently checking their work at each step to be sure of themselves by the way. They are afraid of a fraction. If the result fails to "come out even" they are in despair. If they chance to discover that others in the class get the same result, they take courage, but their own work does not carry conviction, for they have not learned to rely on their own judgment. They are not sensitive to the reading of a problem, and consequently have no basis for a logical method of attack. They fail to see that arithmetic is part of a great mathematical whole . . .[10]

No doubt this opinion, expressed nearly sixty years ago, has been repeated many times since, and would not appear out of place in a School Review of 1956.

The only professional leadership that the mathematics teachers in Alberta received in the early 1900's was that offered by the inspectors on their infrequent visits.

J. A. Smith, of the High River Inspectorate, made several comments that suggest that he was endeavouring to guide the teaching of mathematics in his area:

> I would like to see more original thinking in the study of arithmetic in the higher standards. Encouragement should be accorded the pupil who proposes an alternative form of solution, even though it be long and clumsy, for it is the best solution for the individual, since it is his own thinking. The exultation of individual discovery and accomplishment in invaluable in the study of arithmetic . . . The teaching of algebra in many schools is nothing but a confused juggling with symbols. The weakness in the teaching of this subject I attribute to its entire separation from arithmetic.

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[9] **Annual Report of the Department of Education of the North West Territories, 1902, p. 22.**

[10] Milner, F., "What Ought the Study of Mathematics to Contribute to the Education of the High School Pupil?" School Review, 6: 10-115 (Feb.) 1898, as quoted in Kinney and Purdy: **Teaching Mathematics in the Secondary School, p. 17.**

> The teacher should see that the pupil constantly holds fast to the shoreline of arithmetic while he ventures out upon the sea of algebra.[11]

Inspector Smith's comments were probably a reflection of a general move in both England and United States at this time. Perry in England and Moore in America were calling attention to the need for reorganizing curricula with special emphasis on correlation, rather than strictly compartmentalizing mathematical subjects.[12]

Mechanical application of rules with little reference to practicality was typical of many examination questions in those days. The first two questions from a 1906 final examination in arithmetic illustrate this tendency:

(1) What part of 12 bushels of wheat is

$$\frac{1}{7} \text{ of } \frac{2\frac{1}{4} - \frac{2}{3} \text{ of } \frac{1}{4}}{\frac{1}{5} \text{ of } 3\frac{1}{3} + 1\frac{3}{36}} \text{ of } \frac{2}{11} \text{ of 5698 bushels?}$$

(2) Divide 180 by 3.14159265 correct to five places of demicals.[13]

Dr. Goggin selected C. Smith's *Elementary Algebra* as algebra textbook for the three high school Standards. His choice was apparently a popular one because this book remained in use in Alberta schools for more than twenty years. Each topic in Smith's book was presented by means of definition of terms, followed by examples, and then practice was given in the application of rules. The need for a yearly preliminary review of algebraic theory was recognized, as in Standard VI, Chapter I to XIV were prescribed, in Standard VII, Chapter I to XX, and in Standard VIII, the entire book. Thus the course recommended spiralling, even though Smith's textbook did not follow such a plan.

By the year 1910, regardless of the fact that Dr. Goggin's programme of studies had met with approval, there had been several suggestions that a revision should be made. Perhaps educationalists were anxious to formulate a programme that was strictly an Alberta product. The Alberta Trustees Association, newly organized, early expressed an interest in curriculum. Dr. W. D. Ferris, President of the Association, stated in 1909:

> There are several factors in our school system which tend to injure the health or our growing boys and girls—and what I am saying here applies more especially to the future mothers of our nation. In many cases the hours of study are too long. There is an overload of home work . . . Why should the fast-growing girls of to-day be made the hysterials, neurosthenics and childless wives of to-morrow[14]

In answer to the general demand, a committee, with Dr. Tory as Chairman, was chosen to revise the high school course. Under the

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11Province of Alberta, Department of Education, **Annual Report, 1908,** pp. 53-54.
12Kinney and Purdy, **op. cit.,** p. 23.
13Province of Alberta, Department of Education, **Annual Report, 1906,** p. 133.
14Report of Annual Convention, Alberta School Trustees Association 1909, 1. 17.

revision, which was ready by 1912, mathematics occupied an important place. As yet there was no apparent move against compartmentalization. The new course prescribed algebra and geometry in Grade IX, X, XI, and XII, arithmetic in Grades IX and X, and trigonometry in Grade XII.[15] At no time in the history of the Province has mathematics occupied a more prominent place in the curriculum.

The First Great War Influences Curriculum

The 1912 programme of studies was in use throughout the war years and continued to be in effect until the curriculum revision of 1925 was completed. This period tells a story of inadequately trained teachers, of crowded schools, of expressed doubt as to what the content of the curriculum should be, and of a new concern on the part of the public at large regarding the aims of education.

Educational leaders were aware that with a growing non-selective high school population, reorganization of the academic programme was essential. The Alberta Teachers' Alliance, which had been established during the war years, sent an official questionnaire to all Local Alliances in 1921 requesting discussion of the type of curriculum deemed most desirable. D. L. Shortliffe, an Edmonton mathematics teacher, maintained that two fallacies worthy of thoughtful consideration existed. The first fallacy was that all children are approximately equal in talent, and hence no choice regarding curricula is needed. The second fallacy, which negates the first, is that since not all children have the same ability, the curriculum ought to be adapted to the most poorly equipped. He said:

> Fully fifty per cent of our present high school population, or at any rate, those above Grade IX, should be at good technical, commercial or agricultural schools. Then we could carry on in the various types of schools a system of intensive training with the kind of pupils adapted to it, instead of suffering under the present chaos, which seems to get worse instead of better with every new and high-sounding innovation . . . We simply cannot get results of any sort, theoretical or practical, by trying to teach everything from biscuit-rolling to astronomy to the same individual.[16]

Shortliffe's comments lead us to believe that the nature of the high school population had changed and the selective factor no longer existed.

In 1921, A. B. Hogg, a trustee, stated his opinion regarding curriculum at the trustees' convention:

> . . . I contend we must adhere to the old-fashioned doctrine of the three R's. The three R's, like the alphabet, are not merely funds of knowledge, but are the very means by which one acquires knowledge. A

[15]Province of Alberta, Department of Education, **Annual Report, 1912**, pp. 146-154.
[16]**A.T.A. Magazine, February, 1921**, p. 22.

> boy fifteen years old can learn, fairly well, the science of farming by working on a farm. He can learn it better if he can read well, write well and figure well. But on the farm there is not likely any way of his learning readily to read, write and figure. Let him learn, then, at school, first of all, these essentials. Technical Education or vocational training may well remain a subject for students well advanced.[17]

A truly democratic attitude toward curriculum, no doubt accentuated by post-war opposition to anything dictatorial, was apparent as the background of preparation, for the new programme of studies requested "the opinion of teachers of trustees, of the U.F.A., of the U.F.W.A. of the Women's Institutes, of Boards of Trade, of Canadian Clubs, of Rotary Clubs, of Inspectors, in fact of almost every organization in the Province."[18]

As a result of the revision the number of subjects that any pupil must take was materially reduced, and the student was given five choices from which to select his course: Normal School entrance, matriculation to university, commercial, technical, or a genral course. This new programme, which also introduced the unit system, was established by 1925.

The content of the mathematical subjects, under the revision, was not materially changed except in the amount prescribed. Algebra and geometry were offered for three years instead of four. Algebra lost little in quantity but gained in intensity. Theoretical geometry was to be completed at the junior level and analytical geometry at the senior level. Arithmetic was offered only at the Grade XI level. It was hoped that by reducing the number of subjects, hence increasing the time per subject per week, better results would follow than when the subjects were spread over more years.

Crawford's *High School Algebra* replaced C. Smith's textbook. The authors stated that it was written from the standpoint of the pupil, and in such a form that he would be able to understand it with a minimum of assistance from the teacher.[19] The question method is frequently used in developing the theory.

McDougall and Sheppard's *High School Geometry* replaced Baker's textbook. McDougall and Sheppard aimed to produce a course in theoretical geometry that would be in accord with current scientific and pedagogical thought and would meet the demands of the geometry courses as outlined in the 1925 revision. It appears that the thinking at this time was shifting from the theory of mental discipline, which had long been a popular one, to giving the learner something that would contribute to a broader and more useful life. Transfer of training was also being viewed more realistically and

17 **Alberta School Trustees' Association, Report of Annual Convention, 1921, p. 15.**
18 **Ibid., pp. 46-47.**
19 **J. T. Crawford, High School Algebra, Preface, p. v.**

the hope was expressed that teachers would realize that transfer would not take place unless the work was properly developed.

The Trend Toward Unified Courses

When the 1925 curriculum was introduced it was expected that the average student would be able to undertake and complete seven units per school year. Before long it became apparent that although students were attempting seven units, very few passed that number and the average student could be expected to spend at least five years in high school. The changing nature of the secondary school population was to a large extent responsible for adjustments necessary in the mathematics programme during this period.

The subject that was proving most difficult to the non-selective group of students in high school at this time was the Grade XI course in arithmetic. Under the 1925 revision, arithmetic, which previously had been offered in Grades IX and X, was to be studied for one year only, preferably in Grade XI. Mensuration, percentage, and business mathematics, formed the core of the course. Stanley's *A Canadian Arithmetic for High Schools* was the prescribed textbook in 1925. It is interesting to note that Inspector J. A. Smith when commenting regarding arithmetic, did not recommend that the course be simplified and brought down to the level of the pupil:

> The teachers handling this subject find that the majority of the students have not the necessary thorough background to handle successfully the course prescribed. There seems to be throughout the province a very strong demand for two years of arithmetic in the high school. Raising the standard of the Grade VIII course in arithmetic might meet this demand.[20]

Teachers of the Province generally, in response to Alberta Teachers' Alliance questionnaires, stated that the arithmetic course was far too long. The trustees too, protested by means of resolutions at their annual conventions:

> Resolution No. 25
> Resolved, that the subject of Arithmetic be taught in Grades IX, X, and XI.
> Pincher Creek S.D. No. 121.[21]
>
> Resolution No. 18
> Resolved that the content of Arithmetic in high schools be spread over two years and to meet this that the content of History in IX and X be reduced.[22]

Mr. McNally, in speaking to such resolutions, said:

> Arithmetic is not being taught in Grades IX and X for the simple reason that you cannot reduce the number of subjects carried in any one year without taking something off. With our new and better way of teaching arithmetic in the public school in the elementary grades, and one year of arithmetic in Grade XI confined to the application of practical arithmetic, there is ample attention given to the subject.

20Province of Alberta, Department of Education, **Annual Report, 1925, p. 20.**
21**Alberta School Trustee** Magazine, 1925, p. 64.
22**Alberta School Trustee** Magazine, 1927, p. 36.

The 1939 secondary revision programme deleted arithmetic as a separate course.[23]

By the year 1932 there was much discussion regarding the type of Grade XII mathematics course best suited to the needs of Alberta students. There were educationalists in both the United States and Canada who were advocating unified mathematics. It was not a new idea. As far back as the early 1900's Professor Felix Klein of Germany stated that the fusion of plane and solid geometry, and of arithmetic and geometry, should be encouraged.[24]

Professor William David Reeve of Columbia University recommended that mathematics should not be taught in "water-tight" compartments, but that whenever possible, correlation should take place.[25] Much experimentation in correlation was attempted in the United States and perhaps the most concrete results took the form of general mathematics courses.

It would appear, however, that Alberta teachers were not enthusiastic about the proposed unification of Grade XII mathematics. D. L. Shortliffe, Edmonton, in a letter to the editor of the A.T.A. Magazine, claimed that there were two main advocates of unified mathematics. First, the university professors wanted it because they claimed it was just the preparation needed for the coming scientist or mathematician. The other group, he asserted, was made up of the fond parents of adolescents who found the present course hard. They had the idea that a unified mathematics course would be an easy one. Shortliffe said:

> To a mathematician, trained under the old system, the unified course will look easier than the present course. To the experienced teacher it will appear much harder. They are both correct! The mathematician looks at it from the standpoint of the ease with which he, with his training under another system, can grasp the principles and solve the problems. The teacher looks at it from the point of view of one whose job it is to 'put it over'.[26]

The Algebra 3 course was revised in 1934, at which time a new textbook *A New Canadian Algebra* by Durell and Wright came into use. Elementary work in calculus was included in the high school programme for the first time. *A New Canadian Algebra* presented exercises from which inductions were to be made. The student's concept of the law was to grow gradually as he worked through the examples:

> Repetitions of special types may eventually induce some kind of facility

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23**Alberta School Trustee** Magazine, 1925, p. 64.

24Klein, Professor Felix, **Elementarmathematik vom hoheren Standpunkte aus Theil II, Geometrie,** pp. 435, 437, as in Fifth Yearbook, **National Council of Teachers of Mathematics.**

25**National Council of Teachers of Mathematics,** The Fourth Yearbook, p. 143.

26**A.T.A. Magazine,** July, 1932, pp. 9-16.

> in handling them, but this method dulls the mind; it is variety alone which makes the pupil keep thinking.[27]

The adjustment of many teachers to the content and aims of the new course was not easy. During the Summer School sessions of 1933 and 1934 special classes were held for teachers of Grade XII algebra in order that the revised course might be reviewed.

The results of the 1938 final examination in Algebra 3 showed, in the opinion of the marking group, " a lamentable and widespread ignorance of the most elmentary ideas and manipulations involved in the course."[28] In deploring the poor results, S. W. Hooper said of the Algebra 3 course:

> There is no definite limit to what the course contains. In many questions a principle is implied, the teacher may draw attention to it, and presumably the students understand its significance. Unfortunately in too many cases the principle is met with only once, and teacher and students alike assume that the point, though interesting, is merely a side issue in the general subject under discussion. The result is that the course becomes a voyage of discovery with a great many detours on the way, all of course having some connection with the general route.[29]

He suggested that in theory, the aim of the new course was good, but lack of a definite limit rendered the external examination difficult.

In 1934 the Honorable Perren Baker appointed a General Committee to revise the curriculum. This Committee took into consideration the large heterogeneous school population when they made their recommendations. The revised programme was introduced in all high school grades by 1939. A change was made from the "unit" system to the "credit" system. Algebra I, Geometry I, Algebra 2, and Trigonometry and Analytical Geometry were academic electives worth five credits each. General Mathematics 1, 2, and 3, newly introduced, were optional subjects worth five credits each.

It was hoped that the general mathematics courses would meet the needs of students whose aptitudes did not lie in the field of mathematics and who would not profit from the study of algebra and geometry. The teacher of general mathematics courses was not required to cover any prescribed minimum of work. It was hoped that the students would be kept working at optimum efficiency on meaningful problems. A library of books was suggested in lieu of a single textbook. The programme of studies submitted a list of forty-six books from which to choose.

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[27]C. V. Durell and R. M. Wright, **Senior Algebra, Preface.**

[28]Stead Wannop Hooper, "A Report on the Algebra 3 paper of June, 1938," thesis for M.A. degree, Edmonton, 1941, p. 1.

[29]**Ibid., pp. 54-55.**

The new programme stated, with regard to algebra, that it was intended that the subject be approached from the point of view of the variable and function. The textbook selected in 1937 for Algebra 1 in order to implement that theory was *Algebra for Today* by Betz, Robinson, and Shortliffe. A comment from the report of the high school inspectors in 1938 suggests that the new textbook was meeting with approval:

> The new algebra text is serving to re-direct the work toward more thorough understanding of basic concepts and relationships, and away from long drills on the manipulation of poorly-understood symbols.[30]

Geometry for Today by Cook, which was the prescribed textbook in Geometry 1 at this time, encouraged a more informal approach to geometry. Memorization of propositions was definitely discouraged as the book provided very few proofs, and practical applications of the propositions were emphasized. The student was encouraged to explore, to organize, to devise his own statements of findings and to construct his own proofs.[31]

The course in Trigonometry and Analytic Geometry aimed to "supplement the work of Algebra 2 with respect to the trigonometric functions and the graphical representation of functions."[32] It dealt with some of the geometric properties of conics, and introduced some exercises in mechanics. During the year 1940-41 the course was to be based on material selected from three books: Conant, *Plane Trigonometry;* McDougall and Sheppard, *Analytical Geometry for High Schools;* and Merchant, Chant and Cline, *Mechanics, An Elementary Textbook.* Despite the use of three textbooks, the parts of the course were not to be treated separately. In so far as possible they were to be integrated with frequent reference to relevant parts of the course in Algebra 2. Thus, an attempt to encourage unified mathematics was made.

Recent Revision

By the early 1940's there appeared to be some question as to whether students of mathematics could achieve the same standard as formerly. H. C. Newland, Supervisor of Schools, stated in his Annual Report for 1940 that the new course was apparently acceptable to students, teachers and parents, but that there were still some critics who complained about the lowering of academic standards:

> . . . it must be conceded that the high school group as a whole, embracing as it does a wider range of ability than ever before, cannot reach the same standard in a subject like mathematics that is attained by a select group.

30 **Province of Alberta, Department of Education, Annual Report, 1938,** p. 47.

31 **A. J. Cook, Geometry for Today,** Preface, pp. v-vi.

32 **Program of Studies for the High School,** Bulletin I, 1940, p. 22.

> But with a rigid programme, dominated by academic subjects, only two results were possible; either the standard of achievement was lowered, or a large number of students—almost a majority—was habituated and inured to failure. With the revised programme, students can be graduated from the high school without failure if they elect the subjects proper to their aptitudes and interests; and if only those students attempt advanced mathematics who have a flair for the subject, the standard of achievement will not be lowered; on the contrary it will be raised.[33]

It became clear that the majority of students would persist in selecting algebra and geometry rather than general mathematics. E. L. Fuller, Chief Inspector of Schools, commented with regard to the revised programme, that general mathematics was not fulfilling the high hopes under which it was launched. In many centres the subject was endured as a necessary evil, a hurdle that the C students must surmount in order that they might take their places in the traditional route leading to matriculation.

In 1941 A. J. Cook provided a provisional course for Alberta schools in which he presented a unified treatment of trigonometry and analytical geometry. There seemed to be fairly wide-spread agreement among teachers, by 1945, that the course was too extensive to be covered in one year. The high school inspectors suggested that the difficulty was due to the fact that many students who were attempting the course lacked both interest and ability to complete successfully academic courses in high school mathematics.[34] The curriculum committee investigated and reported with regard to the A. J. Cook textbook in trigonometry and analytical geometry as follows:

> The sub-committee thought that, although the present book contained a great deal of valuable material, its form and style did not meet the needs of the majority of teachers. The sub-committee recommended that a new book be selected for the school term 1947-48, and that this book be Sprague's "Essentials of Plane Trigonometry and Analytical Geometry."[35]

Sprague's textbook, after certain revisions, was prescribed in Alberta high schools in 1947. The reception of the book was favorable.[36]

A report of the Curriculum Branch written by M. L. Watts, Director of Curriculum, for the 1951 Annual Report stated that it was felt that three courses in mathematics, one each in Grades X, XI, and XII should replace the four courses presently required in the academic programme.[37] Consultation between the high school curriculum committee and those members of the university staff who were familiar with the needs of the university with regard to

[33]Province of Alberta, Department of Education, **Annual Report, 1940**, p. 17.
[34]Province of Alberta, Department of Education, **Annual Report, 1945**, p. 33.
[35]Province of Alberta, Department of Education, **Annual Report, 1946**, p. 56.
[36]Province of Alberta, Department of Education, **Annual Report, 1947**, p. 44.
[37]Province of Alberta, Department of Education, **Annual Report, 1951**, p. 53.

mathematics, was recommended. The feeling of the two groups seemed to be:

> While the result will no doubt be that, at the end of Grade XII the amount of content covered is somewhat reduced, it is hoped that the necessary basic training will be given, and if first year university courses are well adjusted to the high school training, again, looking at the program of high school and university as a whole, it is felt that there need be no real lowering of standards.[38]

One feature of the revised mathematics programme was a new nomenclature for all courses. Grade X courses were to have numbers such as 10, 11, and 12; Grade XI courses numbers such as 20, 21, and 22; and Grade XII courses numbers such as 30, 31, and 32.

The chief change in Grade X mathematics was the deletion of general mathematics. Three new courses were introduced. Mathematics 10 is primarily academic in nature, encompassing study of algebra, geometry, and arithmetic. Mathematics 11 is a course in business arithmetic, and Mathematics 12 is intended primarily for students who choose an industrial arts pattern in high school.

At the Grade XI level, Mathematics 20 is basically an algebra course, but since no provision had been made for the teaching of locus and the circle in Mathematics 10, these two topics were added to the Grade XI course. Mathematics 21 and 22 are essentially extensions of the Mathematics 11 and 12 courses.

In 1953 the new Grade XII course in mathematics was introduced. One course, Mathematics 30, took the place of the two formerly offered. Miller and Rourke's *An Advanced Course in Algebra* was the basic textbook. The first three chapters of Sprague's *Plane Trigonometry and Analytic Geometry,* dealing with logarithms, trigonometric ratios, and the solution of the right triangle, were authorized. One chapter from *Mathematics for Canadians,* Book 3, which has reference to systems of equations, formed a third section of the course. The elements of calculus were not included. In the preface to *An Advanced Course in Algebra* the authors state, "Emphasis should be placed, not on the manipulation of expressions and equations but rather on the use and the interpretation of relationships between variable quantities."[39]

It was found advisable the next year to introduce Mathematics 31, a three-credit elective in trigonometry and analytic geometry, for "the small group of students who might need such a course to meet the matriculation requirements of certain universities."[40] The

[38] **Ibid., p. 53.**

[39] **Norman Miller and Robert E. K. Rourke, An Advanced Course in Algebra, Preface, p. vi.**

[40] **Province of Alberta, Department of Education, Annual Report, 1955, p. 49.**

1955-1956 University of Alberta regulations stipulated that Mathematics 31, with B standing or better, would be required for admission to all Bachelor of Science programmes in the physical sciences.[41]

Present Trends

The high school population during the early years was small and selective. There can be no escaping the fact that high school enrolments today are steadily increasing and that the interests and abilities of high school students are exceedingly varied. The Curriculum Branch of the Department of Education asserts:

> Mathematics is valuable and important in the modern world and therefore all students entering high school have need for more mathematical training [42]

Among the factors that are exerting an influence on present-day mathematics curriculum are tradition, modern educational philosopy, examinations, and the university.

Through tradition, subjects such as mathematics, once established in the curriculum, have a tendency to maintain their places. The feeling of satisfaction with the status quo has a stabalizing influence on mathematics curricula.

Traditional ideas regarding transfer of training have been dealt a blow. Professor C. H. Judd challenges teachers of mathematics in this statement:

> Mathematics as a subject cannot be described in my judgment as sure to transfer. All depends on the way in which the subject is handled . . . Transfer is a form of generalization, and training can be of such a type as to hinder generalization.[43]

Professor John Dewey also suggests that the educational values of mathematics represent, not values inherent in the subject itself, but rather possibilities to be realized through effective teaching. He feels that mathematics has a place in a programme of democratic education only if by studying it a student becomes more competent to cope with life.[44]

In the setting of examinations an attempt has been made to keep pace with the changing mathematics curriculum. The 1956 examination in Mathematics 30 presented thirty-seven questions, covering much of the year's work. The examination endeavoured to do more than test the measure of retention of memorized material.

Sub-examiners responsible for the marking of the final examina-

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41**University of Alberta Calendar, 1955-56, p. 46.**

42Province of Alberta, Department of Education, Senior High School, **Curriculum Guide for Mathematics, 1954, p. 2.**

43Taken from **Report of the National Committee on Mathematical Requirements** as quoted in R. E. K. Rourke, **A Target for Teachers of High School Mathematics, p. 4.**

44Claude H. Brown, **The Teaching of Secondary Mathematics, pp. 129-130.**

tion papers in Mathematics 30 in 1955 commented that the students could not handle fractions adequately, their graphs and diagrams were untidy and inaccurate, they failed to set up proper statements, and they lacked precision in mathematical language.[45] These comments are surprisingly similar to those made by F. Milner fifty-seven years earlier.[46]

The university has signified concern for the future of high school mathematics. In 1955 a university professor was invited to mark examination papers in Mathematics 30 in order that the university might receive a picture of the mathematics situation in the Province.[47] Dr. W. G. Hardy, Professor at the University of Alberta, was responsible for a series of articles in the *Edmonton Journal* entitled "Education in Alberta", in which he said:

> . . . a new course, Mathematics 1, to meet the watered-down content of high school mathematics, had to be put into the first year . . . because of the lowering of the standard in high school mathematics it will be more difficult to equip our graduates in engineering properly.[48]

It is apparent that the high school mathematics programme must undergo constant revision if it wishes to keep pace with changing social conditions. To this end, curriculum revision committees are a permanent part of the educational system. The present programme in mathematics with its academic, business, and shop patterns, results in a vast majority of students electing the academic pattern. Thus there is wide divergence of ability among the students in today's mathematics classes. It would appear that there is little recognition of the rights of the more capable students who could benefit from an enriched mathematics programme.

Conclusions

1. The theory of formal discipline to a large extent has been discredited in Alberta schools. Educationalists responsible for courses and textbooks, however, concede the fact that transfer of training is a possibility if made the specific aim of the learning.
2. In Alberta, efforts to fuse mathematical subjects have not been notably successful. An attempt was made to provide an integrated course in trigonometry and analytical geometry but the results of the experiment were disappointing.
3. Courses in general mathematics, introduced in Alberta to accommodate those students whose abilities were not academic in nature, did not achieve their purpose. Most of the high school

[45]Report by Miss E. Jagoe, Chairman of Mathematics 30 markers.

[46]Note statement by Milner, p. 246.

[47]Dr. Crosby of the University of Alberta Mathematics Department joined the group of Mathematics 30 markers.

[48]**Edmonton Journal, February 5, 1954, p. 7.**

students continued to select the traditional algebra and geometry courses.

4. Examinations in Alberta have kept pace with changing philosophies of education. The formal examinations at the beginning of the period were administered to all high school students in all prescribed courses. At the present time, external examinations, based on fairly generalized knowledge, are administered only to students at the Grade XII level.
5. It would appear that the average standard of achievement in mathematics in Alberta, by the time students complete Grade XII, has been lowered. The University has introduced Mathematics 1 to supplement Grade XII mathematics in order that a foundation for the regular university courses may be provided. Heterogeneous grouping practice may be contributing to a lowered standard. It is likely that no single sequential course can meet the needs of all types of students, grouped heterogeneously, in our high schools.

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